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Gretchen A. Mosher
Iowa State University, gamosher@iastate.edu

Nir Keren
Iowa State University, nir@iastate.edu

Steven A. Freeman
Iowa State University, sfreeman@iastate.edu

Charles R. Hurburgh Jr.
Iowa State University, tatry@iastate.edu

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G. A. Mosher, N. Keren, S. A. Freeman, C. R. Hurburgh

Abstract. *Human factors play an important role in the management of safety and quality in an agricultural work environment. Although employee actions and decisions have been identified as a key component of successful occupational safety programs and quality management programs, little attention has been given to the employees' role in these types of programs. This research explored two safety relationships that have theoretical connections but little previous research: the relationship between safety climate and quality climate, and the relationship of the safety and quality climates between the organizational level and the group level within a workplace. Survey data were collected at three commercial grain handling facilities from 177 employees. Employees also participated in safety and quality decision-making simulations. Significant positive predictions were noted for safety and quality climate. Decision-making predictions are also discussed. This research suggests that organizational safety is an important predictor of group safety. In addition, recognizing the larger role that supervisors play in group workplace behavior, more should be done to increase employee perceptions of group-level involvement in quality climate to promote more quality-oriented decision-making by employees.*

Keywords. *Grain handling, Grain quality, Worker safety.*

Human factors play an important, but often overlooked, role in the management of safety and quality in the work environment. Both occupational safety and quality management programs depend on team-oriented employees who can assess situations, follow procedures, and perform required tasks consistently (Das et al., 2008; Luning and Marcelis, 2007). Employee perceptions are hypothesized to play a substantial role in employee behavior. Furthermore, employee decisions are an important precursor to behavior (Newell, et al., 2007). Theoretical perspectives addressing both motivation and employee decision-making processes suggest that employee perceptions of safety are related to employee perceptions of quality, and together these perceptions may influence employee decisions (Das et al., 2008; Evans et al., 2005; Murphy, 2003; Deming, 2000; Maslow, 1970).

Another strong influence on employee decisions is the environment in which the decisions are made (Zohar, 2008; Patterson et al., 2005; Thompson et al., 1998; Simard and

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The authors are **Gretchen A. Mosher,** PhD, Assistant Professor, **Nir Keren,** PhD, Associate Professor, **Steven A. Freeman, ASABE Member,** PhD, Professor, and **Charles R. Hurburgh, ASABE Member,** PhD, Professor, Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, Iowa. **Corresponding author:** Gretchen A. Mosher, Department of Agricultural and Biosystems Engineering, Iowa State University, 218 Industrial Education II, Ames, IA 50011; phone: 515-294-6416; e-mail: gamosher@iastate.edu.

Marchand, 1995). Managers and supervisors affect employee actions in the workplace, but they do so in different ways. Previous research (Zohar, 2008; Thompson et al., 1998; Hofmann et al., 1995) examined the relationship between employee perceptions of organizational climate (which concerns the employee's relationship with management) and employee perceptions of group climate (which concerns the underlying expectations and understandings in the employee's relationship with his or her supervisor).

This research explores two relationships that have received little attention in previous research. The first objective is to explore the relationship between perceptions of safety and perceptions of quality by employees in a commercial grain elevator and how these perceptions affect the employees' choices in safety and quality-related decision-making. The second objective is to explore the relationship between perceptions at the organizational level and perceptions at the group level.

Safety and quality have well known benefits for organizations. Safe workplaces benefit both workers and the organization (Goetsch, 2008). Quality management systems have the potential to increase revenue, improve inventory management, and improve the performance of organizations (Psomas et al., 2010; Naveh and Marcus, 2007; Rao et al., 1997). Employees and the decisions they make play major roles in the success of both types of programs (Cooper and Phillips, 2004; Neal et al., 2000; Howard and Foster, 1999). Additional knowledge of factors impacting employee decisions are helpful to researchers and managers in the development of more responsive educational interventions as well as to provide guidance for spending limited employee training dollars.

Safety and Quality in the Grain Handling Industry

The setting of the research was a commercial grain handling facility. Safety has historically played an important role in operations management at such facilities, but the measurement of quality indicators and quality performance is a more recent area of interest (Hurburgh and Lawrence, 2003; Capmany et al., 2000). Furthermore, work environments within the commercial grain handling industry have no shortage of safety hazards, and production agriculture has long been considered a hazardous profession based on the number of safety incidents recorded annually (Roberts and Field, 2010; Chapman and Husberg, 2008; Lehtola et al., 2008; BLS, 2008). Although employees are well aware of the hazards they face (Walker, 2010), incidents still occur, and fatality and injury rates for the agricultural industry are nearly always higher than those in other industries (BLS, 2010).

Furthermore, quality beyond generic commodity grades has not typically been a primary operational consideration in grain handling (Thakur and Hurburgh, 2009), but this situation is rapidly changing. Production agriculture is becoming more focused on product isolation, source verification, traceability, and other differentiation processes to add value to bulk commodity crops (Miranowski et al., 2004). Even without specialized markets, the quality of grain is a key consideration in its storability, marketability, and end uses (Reed, 2006). Judicious post-harvest management of commodity grains helps prevent spoilage, preserve quality attributes, and establish marketability (Bern and Brumm, 2003; Reed, 2006; Hellevang, 1995). Grain quality researchers (Reed, 2006; Bern et al., 2003) assert that of all attributes to be managed during grain storage, moisture is the most important. Moisture plays a critical role in the development of mold in granular materials such as corn and wheat and is an important component of controlling insects and other foreign material during storage.

Research by Laux (2007) and Thakur (2010) described the operation of quality management systems in grain handling facilities. While their research illustrated several key benefits of tighter management of grain quality in a grain elevator, one area that remains largely unexamined by researchers is how employee actions impact a quality management system in a grain handling facility. These employee actions are especially important when an employee decision determines how a quality process will be interpreted and carried out. For example, handling procedures for an out-of-condition product such as high-moisture corn could be identified as part of a quality management system, providing guidance to employees. However, if the employees, supervisors, or management choose not to follow the guidelines provided by the quality management system, then the success of the system is uncertain.

Theoretical Connections between Safety and Quality

Out-of-condition grain has been identified as a safety hazard by several researchers. In a review of grain engulfments at commercial grain elevators, Freeman et al. (1998) found that out-of-condition grain played a significant role in 81% of incidents. Kingman and Field (2005) identified moldy grain as an important contributor to farm-level grain engulfments and suffocations. In a summary of grain engulfments in the U.S. in 2009, Roberts and Field (2010) noted a positive relationship between out-of-condition grain and the probability of engulfment. All of these summaries are based on a database of U.S. grain engulfments recorded by Purdue University and include all recorded incidents since 1978.

The link between out-of-condition grain and employee safety is only one theoretical connection between safety and quality. The role that management plays in safety (Conchie and Burns, 2008; Flin et al., 2000) and quality systems is also well documented. Quality expert W. Edwards Deming assigns managers the largest role in developing and overseeing quality, viewing quality as a system that management controls (Deming, 2000). Salazar (1989) examines Deming's philosophy in greater detail from a safety perspective, viewing safety as a system that can be improved continuously. Salazar (1989) also notes that, with both safety and quality systems, the goal is less about counting the number of defects or injuries but rather understanding the system that allowed the injury to occur. Dekker (2002) adds that using hindsight to judge the injury is subject to bias and works against the process of learning from the mistake. Deming (2000), Dekker (2002), and Salazar (1989) agree: the goal of evaluating safety and quality systems is to measure the effectiveness of the system, not the nature of the results.

Murphy (2003) also believes that safety and quality goals align very well. Actions and core processes such as the measurement of targeted factors, the use of data to understand variation and quantify relationships between system variables, and learning from feedback and continuous improvement are important in the management of safety and quality. Murphy (2003) also notes the significant role played by management in commencing and sustaining improvements in core processes and actions.

Das et al. (2008) propose a more basic behavioral theory to explain the relationship between safety and quality. They refer to Maslow's hierarchy of needs, which assumes that needs at a lower level (safety) must be satisfied before employees can concentrate on needs at higher levels (quality) (Glickman et al., 2001). Das et al. (2008) also note that motivational theory can partially explain why employees who do not feel safe will fail to pursue quality goals. Employees tend to evaluate choices offered to them on the basis of outcomes (Steel and Konig, 2006). Outcomes of lowered safety are more likely to benefit the employer (Kaminiski, 2001) by saving money on equipment, training, and engineered design. Therefore, working in an unsafe setting (saving the company money at the worker's expense) will limit the employee's motivation to pursue quality-related goals. This is especially true when one considers that, in many cases, employees see little benefit from quality improvement; quality goals largely add value only to the organization (Das et al., 2008).

Zohar and Erev (2007) discuss safety decisions from a social perspective. The consequences of such decisions can be classified as internal outcomes or external outcomes. Internal outcomes affect only the person who is making the decision, while external outcomes affect others. Zohar and Erev (2007) theorize that, in the case of unsafe behavior, the external outcomes of the decision are typically underweighted by the decision maker in favor of savings in time and effort and an increase in productivity. These positive outcomes benefit the worker, supervisor, and management. Savings in time and increased productivity as well as a resistance to procedural change may also impact the quality decisions of employees, supervisors, and management (Das et al., 2008; Brown et al., 2000). In both safety and quality scenarios, the expected outcomes of negative safety and quality decisions could be perceived as favorable in comparison to the outcomes of more positive safety and quality decisions (Keren et al., 2009; Zohar and Erev, 2007).

Given all the factors that have been found to affect the decision-making of employees, the hypothesis of many researchers is that organizational factors have the potential to sway the balance between safe and unsafe choices by employees and, ultimately, impact the behavior of employees (Johnson, 2007; Seo, 2005; Zohar and Luria, 2005; Brown et al., 2000; Neal et al., 2000; Edmondson, 1996). Organizational factors are also hypothesized to influence the choices that employees make regarding quality-related tasks.

Safety and Quality at Two Levels

A second line of research has examined the differences in safety and quality climate between administrative levels. Zohar and Luria (2005) present a multilevel model of safety climate based on a theoretical framework outlined by Zohar (2000, 2003). The model attributes some variation in safety climate to the dynamics of the work group. This model assumes that employees are continually presented with a large number of inconsistent and conflicting demands from both management and supervisors. A second assumption is that, although management may develop policies and regulations, the day-to-day implementation of the resulting tasks is left to the supervisor. Supervisors are often left to interpret management mandates with a great deal of flexibility, resulting in variation between supervisory groups.

Thompson et al. (1998) note that managers and supervisors both play roles in promoting workplace safety, albeit in different ways. Managers determine the degree of politics in the organization's work climate. In many cases, political behavior is usually classified as a negative attribute because it suggests that the needs of the manager are above the needs of the organization (Thompson et al., 1998). In terms of safety, manager actions such as establishing priorities, setting production schedules, and controlling incentives may be influenced by negative workplace politics.

Thompson et al. (1998) also describe supervisory tasks that promote safety. These include monitoring compliance, providing feedback, and providing input to management on employee compliance or failure to comply with organizational policies and procedures. Supervisors also serve as a liaison between employees and management. Conflicts between these two groups can negatively impact interaction programs aimed at improving workplace safety outcomes. Thus, resolving differences in perceptions between the groups should be a priority for managers and supervisors who are serious about improving safety. Alternatively, the supervisor's role in safety involves the degree of fairness the supervisors' use in resolving violations of compliance to safety rules (Thompson et al. 1998). Employees expect supervisors to represent them fairly in the presence of management. If this does not occur, then perceptions of justice will be negatively impacted.

Zohar (2008) adds additional details on the relationship between organizational level and group level safety climates. He differentiates between formal policies, typically created by management, and enforced policy, which is implemented mainly by supervisors. He notes that while managers create policies and procedures for implementing the policies, supervisors execute the policies. He sees differences between the safety climates of the two groups as an inherent part of a multi-level system. The reason for this is because procedures rarely anticipate every possible situation; therefore, supervisors must make choices on how the procedures can be practically implemented. Zohar (2008) believes that supervisors confront systemic conflicts of organizational goals, which force them to use their own judgment in interpreting and implementing formal procedures, resulting in differences between the organizational level (management) climate and the group level (supervisor) climate.

Simard and Marchand (1995) point to factors at "micro" and "macro" levels. Micro-level factors include aspects such as work processes, hazards, and work group cohesiveness, all of which may contribute to workers' willingness to take safety initiatives. Simard and Marchand (1995) found that many micro-level factors are influenced by macro-level factors, such as managerial support and commitment. However, several researchers have noted the difference in perceptions, after workplace accidents, between managers of the facility and first-line supervisors and co-workers of the victim. While management generally attributes accidents to worker attitudes, knowledge, and behavior, supervisors and co-workers of the victim are more likely to blame the work environment, systemic weaknesses in safety, or simple bad luck (Walker, 2010; Kouabenan, 2009; Prussia et al., 2003). Addressing this disconnect between management, supervisors, and workers is important for the success of workplace safety programs and for quality programs (Das et al., 2008; Prussia et al., 2003; Brown et al., 2000).

Psomas et al. (2010) found a link between effective implementation of an ISO-based quality system, commitment and support of senior management, internal motivation of the company, and attributes of the company. All of these factors are indicators of organizational climate (Patterson et al., 2005). Howard and Foster (1999) found that human resource management that increased employee empowerment increased the perceptions of leadership commitment to quality. Evans et al. (2005) found a significant positive relationship between safety climate and quality climate in a wood-processing environment and a negative relationship between safety climate and productivity climate and safety-related events. The lack of research related to quality climates limits the amount of data that describe quality climates at different administrative levels. However, the little research that has been completed in this area has demonstrated that perceptions concerning management's commitment to quality are an important factor in the success of quality management programs in the workplace (Psomas et al., 2010; Das et al., 2008; Evans et al., 2005; Howard and Foster, 1999).

Materials and Methods

This research sought to build on the work of Das et al. (2008) and add to the limited research on the relationship between safety and quality climates as interpreted at two levels of administration. In addition, decisions made by employees in safety and quality scenarios were measured to determine if employee safety choices predict employee quality choices. The following research questions guided the collection and analysis of data:

1. Does safety climate predict quality climate at organizational and group levels?
2. Does organizational safety climate predict group safety climate?
3. Does organizational quality climate predict group quality climate?
4. Do organizational and group safety climates predict the employee's choice in a quality-related decision?
5. Do organizational and group quality climates predict the employee's choice in a safety-related decision?
6. Does an employee choice that promotes safety predict a decision that promotes quality?

Measurement of Data

Data were gathered in three parts. The first two parts consisted of two survey instruments that were used to measure the safety and quality climates at three commercial grain handling facilities. To measure employee perceptions of safety climate, the Organization and Group Level Safety Climate instrument (Zohar and Luria, 2005) was used. The instrument was developed and validated by Zohar and Luria (2005) with 3,952 employees in 36 manufacturing industries to measure two-level safety climate. Johnson (2007) further validated the instrument with an additional 292 employees at three heavy manufacturing locations. Both researchers found evidence to support a three-factor structure for safety climate but also noted highly significant correlations between the three factors and a substantial number of variables on more than one factor. Therefore, both researchers (Johnson, 2007; Zohar and Luria, 2005) concluded that a single factor, termed global commitment, could adequately explain the concept of safety climate at each administrative level.

The instrument consisted of 16 items that measured the employees' perceptions of the relative priority that management gives to safety (organizational climate) and 16 items that measured the employees' perceptions of the relative priority that supervisors give to safety (group climate). Items were scored on a five-point scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree). Factor analysis completed for this project on the safety climate instrument had results similar to those of Johnson (2007) and Zohar and Luria (2005). Highly significant correlations between variables, a large number of cross-loadings, and the initial principal component analysis indicating one factor all contributed to the decision to use a single factor to describe organizational safety climate and a second single factor to describe group safety climate.

The quality climate instrument was constructed based on the validated safety instrument. Items were modified slightly to reflect a quality environment and were scored on the same scale. The 32-item organization and group level safety climate instrument and the 31-item organization and group level quality climate instrument are shown in the Appendix.

The third portion of the study measured employee decision-making patterns in a safety decision and in a quality decision. The safety decision scenario was based on a fundamental safety concern in all work environments: the failure to follow standard operating procedures (SOPs) (Keren et al., 2009; Zohar and Erev, 2007). The scenario was selected to elicit the response of the employee when presented with a potential shortcut opportunity. The presented dilemma occurs commonly in the grain handling industry: the bridging of out-of-condition grain as it is unloaded from a grain storage container to a transportation vehicle (Roberts and Field, 2010; Brandon, 2009; Kingman and Field, 2005; Freeman et al., 1998). The safety decision scenario is shown in the Appendix.

Following SOPs will resolve the issue but will also require additional time, slowing productivity and delaying shipments to clients. Fixing the problem by taking the shortcut presents a major engulfment hazard to the employee. The scenario asks the employee to decide whether to follow safety procedures and take additional time or to fix the problem quickly but with an increased risk of injury or death. The best options from a safety perspective are to either follow the SOP or to report the supervisor to management in hopes of preventing the supervisor from asking other employees to make an unsafe decision. However, these choices may have negative implications for productivity and for how the supervisor views the employee's "team player" behavior. Peer pressure adds another element that could sway the employee's decision; supportive peers can influence the employee to make a positive safety decision (confronting the supervisor), but unsupportive peers can lead the employee to a negative safety decision (entering the bin).

The quality decision scenario investigated in this work concerned the management and storage of wet corn. The scenario asks the employee to make a choice: follow management directives and dump the wet corn onto an unmanaged pile on the ground, or take action to better preserve the quality of the product. Preserving the quality of the product requires one of three actions: refuse to accept the wet corn at the scale, test the corn moisture levels of the pile, or dry the corn before dumping it on the pile. The best option from a quality perspective is to refuse the wet corn entirely and thereby avoid the risk of spoilage. However, this choice has poor implications for customer service and company policy. The other two options (checking the moisture and drying the corn) could work under certain conditions, but they may be limited options for the employee due to administrative and management controls. The worst choice in terms of quality is to accept the wet corn and dump the load onto the unmanaged pile.

The details of the specific quality scenario are less important than the larger point it illustrates. The larger question can be applied across all industries: does the employee follow the instructions from the supervisor and management, even if these instructions do not promote high-quality processes, or does the employee decide to disregard the management and supervisor in favor of a more quality-oriented outcome? A secondary question is whether a choice for safety by the employee will increase the likelihood of a more positive quality decision. The scenario used to measure quality decision-making is shown in the Appendix.

The software platform used was Decision Mind (Decision Mind, 2005), a computerized decision-making simulation. The simulation employs decision process-tracing by recording several key attributes of the decision-making process, including: (1) sequence of information gathered, (2) the number of items viewed, (3) the amount of time needed to complete the decision-making task, and (4) the choice.

The decision process-tracing technique traces the information gathering process by recording data on the information viewed by the employee during a decision task (Mintz, 2004). The process-tracing method used by Decision Mind had several advantages that suited the objectives of this study. First, the ease of use and data storage properties were

Table 1. Decision Mind decision-making simulation matrix.

Dimensions	Choices			
	C_1	C_2	C_3	C_4
D_1	V_{11}	V_{21}	V_{31}	V_{41}
D_2	V_{12}	V_{22}	V_{32}	V_{42}
D_3	V_{13}	V_{23}	V_{33}	V_{43}
D_4	V_{14}	V_{24}	V_{34}	V_{44}

considered, as the decision simulation was to be completed by a group with unknown computer literacy and data storage at remote grain elevators was a concern. The software was relatively easy to use and stored the data collected at a centralized server location rather than at the grain elevator site, addressing both data management and employee anonymity concerns. Second, Decision Mind offered the ability to isolate decision rules and models used in the decision-making process as well as test the association of situational and personal factors with the decision process and the final decision choice. Factors related to the decision-making process and decision choices are not discussed in this research but were part of a larger study using these data.

The decision structure is presented in a matrix format with a set of alternatives and a set of dimensions, as shown in table 1. The dimensions represent factors that may influence the participant's choice. The safety and quality decision scenarios were drawn from information on both types of hypothetical scenarios in the research and popular press (Roberts and Field, 2010; Brandon, 2009; Reed, 2006; Bern and Brumm, 2003). Dimensions in the safety decision scenario included: productivity, safety, supervisor's opinion, and peer pressure. Dimensions in the quality decision scenario included: storage risk, customer service, company policy, and cost to company. Alternatives define the choices available to the participant, and information is gathered by viewing the dimensions. The participant is then asked to choose one alternative based on the information acquired from the dimensions (Mintz, 2004).

Decision choices were presented in a matrix format, as shown in table 1, with four dimensions that were hypothesized to play a role in making the decision. With each decision simulation, employees read the hypothetical situation and were then presented four alternatives. Each square of the matrix (V) represents the evaluation of a given choice (C) on a given dimension (D) and a weighted numerical score (contained within V). Using the information contained in the matrix squares, employees viewed the information and then selected a choice. Further details on the use of the decision matrix in the Decision Mind software are provided by Keren et al. (2009) and at the Decision Mind website (Decision Mind, 2005).

The safety and quality scenarios were developed and critiqued by a panel of experts in agricultural safety and grain elevator operations using a modified Delphi method (Linstone and Turoff, 2002). Scenarios were pilot tested on a small group with a moderate knowledge of grain elevator operations, and slight adjustments were made to the scenarios based on the feedback from this group. The research discussed in this article focused on the relationship of decision choices made by employees. Keren et al. (2009), Mills (2007), and Keren et al. (2006) provide more information on the development, use, and analysis of decision dimensions.

Results

Participants were employees of three Midwestern grain handling companies. Employees were drawn from companies that volunteered for the study. No contact was made between the grain elevator employees and the researchers; rather, all communication was made through the office staff at each facility, who were not included in the study. Additionally, although three companies made up the sample, each company included multiple sites and subjects were drawn from all of the sites. Furthermore, the service area of these three companies covered nearly one-third of the state's area.

Additionally, because a required condition of participation in this study was a two-level administrative system, the grain handling capacities for all three companies were large; varying between 18 and 217 million bushels per year. According to capacity data provided by each grain elevator, the aggregated handling capability of the three (approximately 58.3 million bushels of grain handled per year) makes up roughly 20% of the state's grain handling capacity in an average year (AgClassroom, 2010).

All of the facilities included a two-level administrative system. The management included personnel who had limited interaction with safety or quality decisions, but who created policies and procedures forming the basis for these decisions. Supervisors were responsible for direct supervision of employees and were also involved in making safety and quality decisions in some cases. However, the directions given to the grain handling facilities specified that participants were to be limited to those who were responsible for making safety and quality decisions on the ground, rather than those who were primarily responsible for administration. Employees completed the surveys during work hours, and each employee's response (climate instrument responses and decision scenario choices) was coded to encourage accurate responses and to protect the employee's confidentiality. Employees completed the multiple components as their schedules allowed, using their randomly assigned code numbers. The code numbers were not matched with any employee identity, allowing the responses to be completely confidential for both the researchers and the management and supervisors at each company.

Employees who were subject to safety and quality-related decisions in their daily jobs were offered the opportunity to participate in the project (i.e., those in clerical and administration positions were excluded). Of the 410 invitations, 197 responded. Of these, 177 provided usable data, for a response rate of 43%. Data were collected during a four-month period in the spring of 2010. Mean responses from all companies were measured to rule out significant effects from one company in the sample. No significant differences were found between companies in any of the demographic variables, so the data from all three companies were aggregated for analysis. Additionally, no demographic variables were found to be significantly different in their relationship with the study variables (organizational and group safety and quality climates, and safety and quality decision choices). Demographic data are shown in table 2.

Scale items were highly correlated in both safety and quality climate measures, so factor analysis was performed to identify orthogonal variables in each instrument. For reasons of brevity, these data are not included in this article. They are available from the first author by request. Both the organizational and group safety climate variables loaded on one factor. High loadings on each item resulted in the decision to use the aggregated means of individual organizational and group level safety climate responses to represent one universal safety climate factor. Scale reliability was evaluated using Cronbach's alpha coefficient, and both met generally acceptable standards for reliability, with a coeffi-

Table 2. Demographic characteristics of each grain elevator facility.

Site	Gender		Age					Years Worked			
	M	F	<30	31-40	41-50	51-60	>61	<5	5-10	10-15	>15
Company 1 (N = 33)	28	5	5	7	10	9	2	13	5	8	7
Company 2 (N = 19)	16	3	4	3	7	3	2	10	3	4	2
Company 3 (N = 125)	98	27	27	19	39	35	5	68	16	20	21

Table 3. Mean climate responses by site and for all sites (n = 177).[a]

Climate	Company 1	Company 2	Company 3	All
Organizational safety	1.92	2.09	1.97	1.97
Group safety	1.93	2.17	2.12	2.10
Organizational quality	1.85	2.19	2.00	2.00
Group quality	1.73	2.00	2.03	1.98

[a] 1 = positive climate evaluation, 5 = negative climate evaluation.

cient of 0.95 for the organizational level and 0.97 for the group level (Bryman and Cramer, 2009, pp. 77-80).

Mean climate responses by site and in aggregated form are presented in table 3. No significant differences were noted between the responses from each site, nor were any of the sites significantly different from the aggregated mean.

Similar results were noted for the quality climate measures. As with the safety climate scales, the instrument was divided into two components for analysis: 16 items were used to measure organizational quality climate, and 15 items were used for group quality climate. Both sets of items loaded on one factor. Factor loadings on each were high (above 0.67 for organizational level and above 0.71 for group level), and these values led to the decision to aggregate individual means for the variables into one universal factor to represent organizational quality climate and one universal factor to represent group quality climate. Scale reliability was evaluated using Cronbach's alpha coefficient, and both scales were found to meet generally accepted standards for scale reliability, with a value of 0.96 for the organizational scale and 0.97 for the supervisory scale.

Using SPSS (ver. 18.0), bivariate two-tailed correlations were calculated to illustrate the direction and strength of the relationship between variables. These data are presented in table 4. Higher values indicate a stronger relationship between the variables. A positive value indicates a positive relationship, while a negative value indicates a negative relationship.

Figure 1 illustrates the factors impacting safety and quality decisions and provides a model of the research questions tested in this research. The magnitudes of the relationships of the variables are also shown. The values in figure 5 are coefficients of determina-

Table 4. Bivariate correlations between safety and quality variables (n = 185).[a]

Variable	1	2	3	4	5	6
Organizational safety climate	1					
Group safety climate	0.774**	1				
Organizational quality climate	0.654**	0.691**	1			
Group quality climate	0.185*	0.225**	0.242**	1		
Safety decision	-0.219**	-0.185*	-0.296**	-0.035	1	
Quality decision	-0.163*	-0.133	-0.217**	-0.003	0.141	1

[a] ** = $p < 0.01$; * = $p < 0.05$.

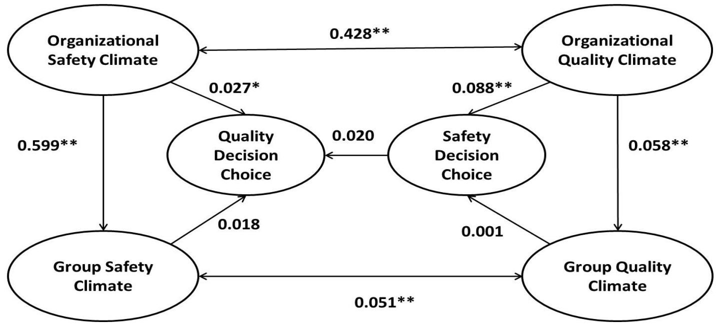

Figure 1. Safety and quality model with r^2 values (= $p < 0.01$; * = $p < 0.05$).**

Table 5. Safety and quality decision-making scenario results.

Safety Decision Scenario (n = 163)	Percentage Choosing (%)	Quality Decision Scenario (n = 158)	Percentage Choosing (%)
Enter bin	4	Dump corn	40
Follow safety procedure	32	Check moisture in pile	40
Confront supervisor	35	Dry corn first	16
Report supervisor to management	29	Do not accept corn	4

tion, i.e., the squared value of the bivariate correlation (r^2). This value denotes the amount of variance in one variable as explained by the other. For example, organizational safety climate explains nearly 43% ($r^2 = 0.428$) of the variance in organizational quality climate but only about 3% ($r^2 = 0.027$) of the variance in the quality decision of an employee.

Table 5 shows the results for the safety and quality decision scenarios by the percentages of employees who chose each option. Mosher (2011) discusses the results and data from the decision-making scenarios in more detail. The sample sizes differ in part because the employees were allowed to complete the multiple components of the data collection process as their schedules permitted. This resulted in some missing and incomplete data.

Discussion

Data were able to answer the research questions conclusively. The first research question asked whether organizational and group safety climate could predict organizational and group quality climate. For both pairs of variables, relationships between safety climate and quality climate exhibited a positive and significant relationship, indicating that a positive safety climate is more likely to encourage a positive quality climate. The strength of the relationship between organizational safety climate and organizational quality climate were surprising, given that few employees of grain handling facilities think the two goals have anything in common. Another noteworthy finding was the relationship between safety and quality climates at the group level. Although it is a significant relationship, the strength of the relationship from a work group perspective is much less than the same relationship at the organizational level. This finding suggests that employees do not connect the administration of quality with their supervisors nearly as much as they do with their management team.

This finding aligns with Deming's (2000) thoughts on the role of management in the development and implementation of quality processes within an organization. However, although management plays a large role in setting quality protocols and pushing organizational changes that result from quality management systems, the supervisors implement the routine tasks and procedures on a daily basis. Strengthening the employees' perceptions of the connection between group quality climate and their supervisor should be a priority for leaders who wish to introduce quality management systems to their employees.

The second and third research questions concerned levels of safety and quality climate at the two administrative levels. The significant positive relationships noted between organizational and group safety climates confirmed a similar relationship reported by Johnson (2007), Zohar and Luria (2005), and Thompson et al. (1998). The role of management in setting organizational safety priorities and influencing work group priorities for safety procedures makes both logical and theoretical sense.

The same relationship strength does not exist for quality climate at both administrative levels. Although Howard and Foster (1999) observed that quality tends to flourish under strong management commitment, little additional empirical evidence has confirmed this. A significant positive relationship was found between organizational and group level quality climate in this research, but from a practical standpoint, less than 6% of the variance in group level climate was explained by organizational quality climate. This suggests that perceptions of management's commitment to quality have less influence on how employees' feel about their supervisor's relative commitment to quality than was observed for safety climate.

The fourth and fifth research questions concerned the relationships of quality climate with safety decisions and safety climate with quality decisions. The data offer both expected and unexpected findings. As specified in Maslow's theory of human needs (Maslow, 1970) and previous research (Das et al., 2008), a positive significant relationship was noted between organizational safety climate and positive quality decisions, indicating that employees make decision choices that encourage quality when they feel positively about safety. Again, this supports the quality theories offered by Deming (2000) and Howard and Foster (1999). However, the limited involvement that most management teams have in daily employee decisions, particularly those involving quality, makes this finding somewhat unexpected.

In addition, the strength of the organizational level finding is even more unexpected in light of the lack of findings at the group level. The relationship between group safety climate and quality decision choices was not significant, indicating little or no connection between how safety is perceived within the work group and the employees' choices in a quality decision. Given the frequent interaction between supervisors and employees, the lack of a significant relationship is unexpected.

Additionally, a significant relationship was noted between organizational quality climate and employee safety decisions, even though it lacked a theoretical basis. As with the safety climate and quality decision relationship, no significant group level relationship with safety decisions was observed. In the workplace environment, this could be partially explained by the properties of many quality management systems. As an integral part, such systems include detailed descriptions of employee actions, tasks, and daily duties, including handling of emergencies and out-of-specification products. Perhaps the discipline of the quality system also promotes safety discipline, as suggested by several researchers (Das et al., 2008; Brown et al., 2000; Salazar, 1989). This relationship warrants further investigation to determine whether it is an isolated finding or true for many agricultural workplaces.

The final research question asked whether employees who made positive safety decisions were more likely to make positive quality decisions as well. No significant relationship was found in this case to validate the theoretical basis first proposed by Maslow (1970) and later found by others (Das et al., 2008). Safety is hypothesized by many researchers to be an important precursor to worker involvement in quality processes (Das et al., 2008; Murphy, 2003; Brown et al., 2000; Deming, 2000), yet little association was found between safety and quality decisions in this context. Future research could examine whether this outcome is different in different work contexts or with different decision-making scenarios, both in agriculture and in other industries.

Conclusions

Like all research involving humans, this work is subject to several limitations. The small sample and the cross-sectional data collection may limit the extrapolation to other situations and work environments. Selection bias is always present to some degree when subjects volunteer to participate, and this bias could be present in this work. In addition, a new tool was used to collect decision-making data; because of its newness, it may add measurement error to the data collection process. Quality climate is a concept that has not been tested repeatedly, potentially adding unwanted and uncontrolled error to the results. This work was the first attempt at developing stronger theoretical connections between safety and quality in a commercial grain handling environment. Therefore, this research does not begin to establish the kind of evidence needed for theory development, and this is fully acknowledged by the researchers. Moreover, the work tested only one safety scenario and one quality scenario. Consequently, the results cannot be generalized to other work tasks, although the broad decision concepts could be tested in other situations to address this weakness. Finally, decision simulations measure employee intentions and not employee behavior, so employees may behave in ways other than how they responded to the decision scenario. This is an inherent limitation to leading indicators of both safety and quality as well as with decision-making research.

Findings from this research suggest that the linkages between safety and quality climates are in place, although not at all levels. More work is needed to connect quality climate to the group level and the supervisor, where many decisions regarding quality and work procedures are made. Increasing the communication between departments of safety and quality may partially address this gap, but bridging safety and quality is a long-term proposition, especially in commercial grain handling, where the two concepts have not had a strong historical association among employees. A systemic approach to managing safety and quality in a grain handling environment may improve performance in both areas. Managing the two from separate perspectives, and departments, does not appear to be a good methodology, given their apparent connectedness.

Future research should continue to investigate the linkages between workplace safety and quality, focusing on ways to align supervisors more closely with daily quality processes. In addition, the relationship between quality management systems and safety decisions calls for further investigation, both from an operational perspective as well as a theoretical viewpoint. Future research should also expand the decision-making scenarios, especially in the area of quality management systems. Human factors play a major role in the success of occupational safety programs and quality management systems (Chrusciel, 2004; Goetsch, 2008; Lunning and Marcelis, 2007). To better understand the success and failure of quality management systems, our understanding of these human factors must increase.

References

AgClassroom. 2010. A look at Iowa agriculture. Washington, D.C.: USDA National Institute of Food and Agriculture (NIFA), Agriculture in the Classroom. Available at: www.agclassroom.org/kids/stats/iowa.pdf. Accessed 23 March 2011.

Brandon, H. 2009. Grain storage: Deadly dangers. *Delta Farm Press* (4 Aug.). Available at: http://deltafarmpress.com/equipment/grain-storage-deadly-dangers. Accessed 6 August 2009.

Bern, C. J., and T. J. Brumm. 2003. Moisture content measurement. In *Encyclopedia of Agricultural, Food, and Biological Engineering*. D. R. Heldman, ed. New York, N.Y.: Marcel Dekker.

Bern, C. J., G. Quick, and F. L. Herum. 2003. Harvesting and postharvest management. In *Corn: Chemistry and Technology*, 129-131. P. J. White and L. A. Johnson, eds. St. Paul, Minn.: American Association of Cereal Chemists.

BLS. 2008. Workplace injuries and illnesses: 2007. Washington, D.C.: Bureau of Labor Statistics. Available at: www.bls.gov/news.release/pdf/osh.pdf. Accessed 16 March 2009.

BLS. 2010. Census of fatal occupational injuries summary, 2009. Washington, D.C.: Bureau of Labor Statistics. Available at: www.bls.gov/news.release/cfoi.nr0.htm. Accessed 23 August 2010.

Brown, K. A., P. G. Willis, and G. E. Prussia. 2000. Predicting safety employee behavior in the steel industry: Development and test of a sociotechnical model. *J. Operations Mgmt.* 18(4): 445-465.

Bryman, A., and D. Cramer. 2009. *Quantitative Data Analysis with SPSS 14, 15, & 16: A Guide for Social Scientists.* London, U.K.: Routledge.

Capmany, C., N. H. Hooker, O. Teofilo, and A. Tilburg. 2000. ISO 9000: A marketing tool for U.S. agribusiness. *Intl. Food and Agribusiness Mgmt. Review* 3(1): 41-53.

Chapman, L. J., and B. Husberg. 2008. Rapporteur's report: Agriculture, forestry, and fishing sector. *J. Safety Res.* 39(2): 171-173.

Chrusciel, D. 2004. Considerations for dealing with significant organizational change. Unpublished PhD diss. Dissertation Abstracts International A65/08. Ames, Iowa: Iowa State University.

Conchie, S. M., and C. Burns. 2008. The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk Analysis* 28(1): 141-149.

Cooper, M. D., and R. A. Phillips. 2004. Exploratory analysis of the safety climate and safety behavior relationship. *J. Safety Res.* 35(5): 497-512.

Das, A., M. Pagell, M. Behm, and A. Veltri. 2008. Toward a theory of the linkages between safety and quality. *J. Operations Mgmt*. 26(4): 521-535.

Decision Mind. 2005. The Decision Mind: Computerized Decision Process Tracing (CDPT). Available at: http://safety-dm.abe.iastate.edu/DecisionBoard/zzzinex.asp. Accessed 1 May 2012.

Dekker, S. W. A. 2002. Reconstructing human contributions to accidents: The new view on error and performance. *J. Safety Res.* 33(3): 371-385.

Deming, W. E. 2000. *Out of the Crisis*. Cambridge, Mass.: MIT Press.

Edmondson, A. C. 1996. Learning from mistakes is easier said than done: Group and organizational influences on the detection and correction of human error. *J. Applied Behavioral Sci.* 32(1): 5-28.

Evans, D. D., J. H. Michael, J. K. Wiedenbeck, and C. D. Ray. 2005. Relationships between organizational climates and safety-related events at four wood manufacturers. *Forest Products J.* 55(6): 23-29.

Flin, R., P. Mearns, P. O'Connor, and R. Bryden. 2000. Measuring safety climate: Identifying the common features. *Safety Sci*. 34(1-3): 177-192.

Freeman, S. A., K. W. Kelley, D. E. Maier, and W. E. Field. 1998. Review of entrapments in bulk agricultural materials at commercial grain facilities. *J. Agric. Safety and Health* 4(2): 119-130.

Glickman, C. D., S. P. Gordon, and J. M. Ross-Gordon. 2001. Adult and teacher development within the context of the school: Clues for supervisory practice. In *Supervision and Instructional Leadership: A Developmental Approach*, 81-85. C. D. Glickman, S. P. Gordon, and J. M. Ross-

Gordon, eds. Needham Heights, Mass.: Allyn and Bacon.
Goetsch, D. L. 2008. *Occupational Safety and Health for Technologists, Engineers, and Managers*. 6th ed. Upper Saddle River, N.J.: Pearson/Prentice Hall.
Hellevang, K. J. 1995. Grain moisture content effects and management. Document AE-905. Fargo, N.D.: North Dakota State University Extension Service. Available at: www.ag.ndsu.nodak.edu/abeng/pdffiles/ae905.pdf. Accessed 21 April 2009.
Hofmann, D. A., R. Jacobs, and F. Landy. 1995. High reliability process industries: Individual, micro, and macro organizational influences on safety performance. *J. Safety Res.* 26(3): 131-149.
Howard, L. W., and S. T. Foster. 1999. The influence of human resource practices on empowerment and employee perceptions of management commitment to quality. *J. Qual. Mgmt*. 4(1): 5-22.
Hurburgh, C. R., and J. D. Lawrence. 2003. The need for QMS. *Resource: Engineering and Technology for a Sustainable World* 10(9): 29. St. Joseph, Mich.: ASAE.
Johnson, S. E. 2007. The predictive validity of safety climate. *J. Safety Res.* 38(5): 511-521.
Kaminski, M. 2001. Unintended consequences: Organizational practices and their impact on workplace safety and productivity. *J. Occup. Health Psych.* 6(2): 127-138.
Keren, N., S. A. Freeman, and C. V. Schwab. 2006. Does SH&E education in high education institutes lead to a change in cognitive patterns among graduates? *J. SH&E Research* 3(2). Available at: www.asse.org/academicsjournal/archive/vol3no2/06summer_keren.pdf.
Keren, N., T. R. Mills, S. A. Freeman, and M. C. Shelley. 2009. Can level of safety climate predict level of orientation toward safety in a decision making task? *Safety Sci.* 47(10): 1312-1323.
Kingman, D. M., and W. E. Field. 2005. Using fault tree analysis to identify contributing factors to engulfment in flowing grain in on-farm grain bins. *J. Agric. Safety and Health* 11(4): 395-405.
Kouabenan, D. R. 2009. Role of beliefs in accident and risk analysis and prevention. *Safety Sci.* 47(6): 767-776.
Laux, C. M. 2007. The impacts of a formal quality management system: A case study of implementing ISO 9000 at Farmer's Cooperative Company, Iowa. Unpublished PhD diss. Ames, Iowa: Iowa State University.
Lehtola, C. J., C. M. Brown, and W. J. Becker. 2008. Grain handling facilities: OSHA standard 1910.272. Gainesville, Fla.: Institute of Food and Agricultural Sciences, University of Florida. Available at: http://edis.ifas.ufl.edu/pdffiles/OA/OA11000.pdf. Accessed 16 June 2008.
Linstone, H. A., and M. Turoff. 2002. *The Delphi Method: Techniques and Applications*. Online textbook. Newark, N.J.: New Jersey Institute of Technology. Available at: http://is.njit.edu/pubs/delphibook. Accessed 4 August 2008.
Lunning, P. A., and W. J. Marcelis. 2007. A conceptual model of food quality management functions based on a techno-managerial approach. *Trends in Food Sci. and Tech.* 18(3): 159-166.
Maslow, A. 1970. *Motivation and Personality.* 2nd ed. New York, N.Y.: Harper and Row.
Mills, T. R. 2007. The effects of a safety climate on safety decision-making. Unpublished MS thesis. Ames, Iowa: Iowa State University.
Mintz, A. 2004. Foreign policy decision making in familiar and unfamiliar settings: An experimental study of high-ranking military officers. *J. Conflict Resolution* 48(1): 91-104.
Miranowski, J. A., H. H. Jensen, P. Batres-Marquez, and A. Ishdorj. 2004. Product differentiation and segregation in agricultural systems: Non-genetically modified and specialty corn and soybean crops in Iowa. Paper No. 04-WP 354. Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development.
Mosher, G. A. 2011. Measurement and analysis of the relationship between employee perceptions and safety and quality decision-making in the country grain elevator. Unpublished PhD diss. Ames, Iowa: Iowa State University.
Murphy, D. J. 2003. Human behavior theories, models, and applications. In *Looking Beneath the Surface of Agricultural Safety and Health*, 45-67. D. J. Murphy, ed. St. Joseph, Mich.: ASAE.
Naveh, E., and A. Marcus. 2007. Financial performance, ISO 9000 standard, and safe driving practices effects on accident rate in the U.S. motor carrier industry. *Accident Analysis and Prev.*

39(4): 731-742.
Neal, A., M. A. Griffin, and P. M. Hart. 2000. The impact of organizational climate on safety climate and individual behavior. *Safety Sci.* 34(1-3): 99-109.
Newell, B. R., D. A. Lagnado, and D. R. Shanks. 2007. *Straight Choices: The Psychology of Decision Making.* New York, N.Y.: Taylor and Francis.
Patterson, M. G., M. A. West, V. J. Shackleton, J. F. Dawson, R. Lawthom, S. Maitlis, D. L. Robinson, and A. M. Wallace. 2005. Validating the organizational climate measure: Links to managerial practices, productivity, and innovation. *J. Org. Behavior* 26(4): 379-408.
Prussia, G. E., K. A. Brown, and G. P. Willis. 2003. Mental models of safety: Do managers and employees see eye to eye? *J. Safety Res.* 33(2): 143-156.
Psomas, E. L., C. V. Fotopoulos, and D. P. Kafetzopoulos. 2010. Critical factors for effective implementation of ISO 9001 in SME service companies. *Managing Service Qual.* 20(5): 440-457.
Rao, S. S., T. S. Ragu-Nathan, and L. E. Solis. 1997. Does ISO 9000 have an effect on quality management practices? An international empirical study. *Total Qual. Mgmt*. 8(6): 335-346.
Reed, C. R. 2006. *Managing Stored Grain to Preserve Quality and Value*. St. Paul, Minn.: AACC.
Roberts, M., and B. Field. 2010. A disturbing trend: U.S. grain entrapments on the increase. *Resource: Engineering and Technology for a Sustainable World* 17(4): 10-11. St. Joseph, Mich.: ASABE.
Salazar, N. 1989. Applying the Deming philosophy to the safety system. *Prof. Safety* 34(12): 22-27.
Seo, D. C. 2005. An explicative model of unsafe work behavior. *Safety Sci.* 43(3): 187-211.
Simard, M., and A. Marchand. 1995. A multilevel analysis of organizational factors related to the taking of safety initiatives by work groups. *Safety Sci.* 21(2): 113-129.
Steel, P., and C. J. Konig. 2006. Integrating theories of motivation. *Acad. Mgmt. Review* 31(4): 889-913.
Thakur, M. 2010. Operational techniques for implementing traceability in bulk product supply chains. Unpublished PhD diss. Ames, Iowa: Iowa State University.
Thakur, M. and C. R. Hurburgh. 2009. Framework for implementing traceability system in the bulk grain supply chain. *J. Food Eng.* 95(4): 617-626.
Thompson, R., T. Hilton, and A. Witt. 1998. Where the rubber meets the shop floor: A confirmatory model of management influence on workplace safety. *J. Safety Res.* 29(1): 15-24.
Walker, G. W. 2010. A safety counterculture challenge to a “safety climate.” *Safety Sci.* 48(3): 333-341.
Zohar, D. 2000. A group-level model of safety climate: testing the effect of group climate on microaccidents in manufacturing jobs. *J. Applied Psych.* 85(4): 587-596.
Zohar, D. 2003. The use of supervisory practices as leverage to improve safety behavior: A cross-level intervention model. *J. Safety Res.* 34(5): 567-577.
Zohar, D. 2008. Safety climate and beyond: A multi-level multi-climate framework. *Safety Sci.* 46(3): 376-387.
Zohar, D., and I. Erev. 2007. On the difficulty of promoting workers’ safety behavior: Overcoming the underweighting of routine tasks. *Intl. J. Risk Assess. and Mgmt*. 7(2): 122-136.
Zohar, D., and G. Luria. 2005. A multilevel model of safety climate: Cross-level relationships between organization and group-level climates. *J. Applied Psych.* 90(4): 616-628.

Appendix

Organizational Level Safety Climate

Please answer the following questions about your organization's top management team.

Top management in this organization . . .	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree
React quickly to solve problems when told about safety hazards.	1 2 3 4 5
Insist on thorough and regular safety audits and inspections.	1 2 3 4 5
Try to continually improve safety levels in each work area.	1 2 3 4 5
Provide all the equipment needed to do the job safely.	1 2 3 4 5
Are strict about working safely even when work falls behind schedule.	1 2 3 4 5
Quickly correct any safety hazard no matter what the cost.	1 2 3 4 5
Provide detailed safety reports to workers regarding injuries, near accidents, etc.	1 2 3 4 5
Consider a person's safety behavior when moving or promoting people.	1 2 3 4 5
Require each manager to help improve safety in his or her work area.	1 2 3 4 5
Invest a lot of time and money in safety training for workers.	1 2 3 4 5
Use any available information to improve safety rules.	1 2 3 4 5
Listen to workers' ideas on improving safety.	1 2 3 4 5
Consider safety when setting production and speed schedules.	1 2 3 4 5
Provide workers with a lot of information on safety issues.	1 2 3 4 5
Regularly hold safety awareness events (meetings, presentations, etc.)	1 2 3 4 5
Give safety personnel the power they need to do their job.	1 2 3 4 5

Group Level Safety Climate

Please answer the following questions about your supervisor or supervisors.

My supervisor(s) …	1 = Strongly agree 2= Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree				
Makes sure we all receive the equipment needed to do the job safely.	1	2	3	4	5
Frequently checks to see if we are all obeying safety rules.	1	2	3	4	5
Discusses how to improve safety with us.	1	2	3	4	5
Uses explanations (not just forced compliance) to get us to act safely.	1	2	3	4	5
Emphasizes safety procedures when we are working under pressure.	1	2	3	4	5
Frequently tells us about the hazards in our work.	1	2	3	4	5
Refuses to ignore safety rules when work falls behind schedule.	1	2	3	4	5
Makes sure we follow all the safety rules (not just the most important ones).	1	2	3	4	5
Insists we obey safety rules when fixing equipment or machines.	1	2	3	4	5
Praises workers who pay special attention to safety.	1	2	3	4	5
Is strict about safety at the end of the day when we want to go home.	1	2	3	4	5
Spends time helping us learn to see problems before they arise.	1	2	3	4	5
Frequently talks about safety issues throughout the work week.	1	2	3	4	5
Insists we wear our protective equipment even if it is uncomfortable.	1	2	3	4	5
Is strict about working safely when we are tired or stressed.	1	2	3	4	5
Reminds workers who need them to work safely.	1	2	3	4	5

Organizational Level Quality Climate

Please answer the following questions about your organization's top management team.

Top management in this organization ….	1= Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree				
React quickly to solve problems when told about quality issues.	1	2	3	4	5
Insist on thorough and regular quality audits and inspections.	1	2	3	4	5
Emphasize the importance of continuous quality improvement in each work area.	1	2	3	4	5
Provide all the means needed to perform jobs in a high-quality manner.	1	2	3	4	5
Are strict about quality requirements even when work falls behind schedule.	1	2	3	4	5
Quickly correct any quality errors no matter what the cost.	1	2	3	4	5
Provide detailed quality reports regarding work tasks and performance.	1	2	3	4	5
Consider a person's attitude toward quality when moving or promoting people.	1	2	3	4	5
Require each manager to help improve quality in his or her work area.	1	2	3	4	5
Invest a lot of time and money in quality training for workers.	1	2	3	4	5
Use any available information to improve quality protocols.	1	2	3	4	5
Listen to workers' ideas on continuous quality improvement.	1	2	3	4	5
Consider quality standards when setting production and speed schedules.	1	2	3	4	5
Provide workers with continuous feedback on quality performance.	1	2	3	4	5
Regularly hold quality awareness events (meetings, presentations, updates, etc.)	1	2	3	4	5
Give quality leaders the power they need to meet quality goals.	1	2	3	4	5

Group Level Quality Climate

Please answer the following questions about your supervisor or supervisors.

My supervisor(s) …	1= Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree				
Makes sure we all receive the means and support needed to meet quality requirements.	1	2	3	4	5
Frequently checks to see if we are all complying with quality requirements.	1	2	3	4	5
Discusses ways to improve quality with us.	1	2	3	4	5
Uses explanations (not just forced compliance) to improve product quality.	1	2	3	4	5
Emphasizes quality procedures when we are working under pressure.	1	2	3	4	5
Refuses to ignore quality requirements when work falls behind schedule.	1	2	3	4	5
Makes sure we follow all the quality procedures (not just the most important ones).	1	2	3	4	5
Insists we follow quality requirements when fixing equipment or machines.	1	2	3	4	5
Praises workers who pay special attention to quality.	1	2	3	4	5
Is strict about quality at the end of the day when we want to go home.	1	2	3	4	5
Spends time helping us learn to see quality problems before they arise.	1	2	3	4	5
Frequently talks about quality issues throughout the work week.	1	2	3	4	5
Insists we follow through on quality requirements even when it's inconvenient.	1	2	3	4	5
Is strict about quality protocols when we are tired or stressed.	1	2	3	4	5
Reminds workers who need them to work with quality in mind.	1	2	3	4	5

Safety Decision Scenario
You and a co-worker are emptying a bin and working to fill a waiting truck. Your supervisor walks by to check on your progress and notices the flow of grain to the truck has slowed. Your supervisor suggests keeping the auger running while someone gets inside the bin to release the blockage and keep the grain flowing. You are surprised because your organization normally follows the grain safety handling standard administered by OSHA, which require lock out / tag out of the bin before entry. You need to decide what to do next.

You have the following four options:

1. Enter the grain bin to release the blockage.
2. Follow the correct entrance procedures, taking appropriate time to resolve the flow problem safely.
3. Confront your supervisor, telling him you will follow the entrance safety procedures even if it will slow the work.
4. Follow the correct procedure and then report the supervisor's instructions to management.

These four factors could impact your decision:

1. Safety
2. Productivity
3. Supervisor's opinion of you
4. Peer pressure

Quality Decision Scenario
Long-term storage of wet corn has been a continuing problem at the grain cooperative where you work. The policy of the cooperative is that no member of the cooperative should be turned away from delivering corn; all loads are received and stored somewhere. A member of the cooperative pulls in with a load of very wet corn. You are directed to dump the load directly on a large uncovered pile of corn on the ground near the storage bins. You do not know the moisture levels of the corn in the pile. You must decide on the next step.

The following four items are your options:

1. Dump the corn on the pile as directed, and document your action.
2. Do not accept the wet corn from the customer.
3. Insist on drying the corn before dumping it on the pile.
4. Check the moisture level in the pile before deciding where to dump the corn.

These four factors could impact your decision:

1. Storage risk
2. Customer service
3. Costs to company
4. Company policy